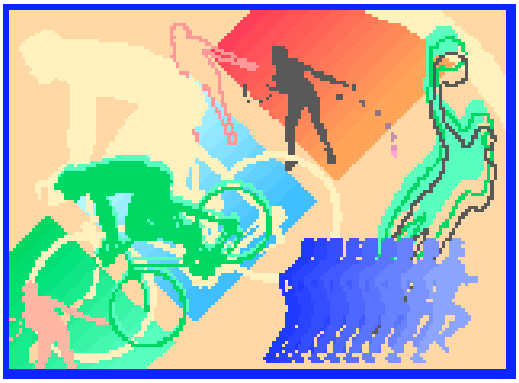
5 Cardiorespiratory Training

In this chapter you will learn about:

- The physiology of the heart and lungs.
- Benefits of cardio-respiratory training.
- The FITT Principle guidelines for cardio-respiratory training.
- Aerobic-training program design and progression.

Cardiorespiratory activities make up the bulk of the physical activities in Levels 1 and 2 of the Physical Activity Pyramid (Chapter 4, Figure 4-2). These activities improve health and fitness by increasing the work capacity of the heart and lungs. Other terms used to describe these activities include

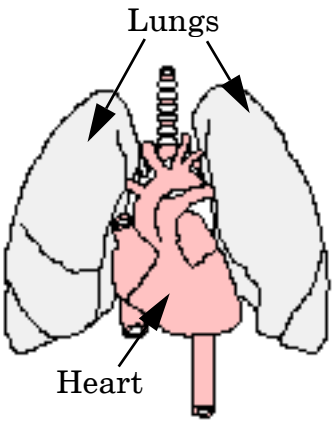


Cardiorespiratory Physiology

The heart is a muscle that is required to contract continuously throughout your life to deliver oxygen to all organs in the body. Your lungs breathe in oxygen and breathe out carbon dioxide. Blood vessels connect the heart and lungs so that carbon dioxide can be removed from the blood and oxygen can be added to the blood. The heart then pumps this blood throughout the body. During exercise your heart must pump more often and more strongly to supply oxygen to your exercising muscles to make energy. In turn, you

breathe in more often and more deeply to increase the amount of oxygen you inhale and carbon dioxide that you exhale.

The basis of cardiorespiratory training is to place greater demands on the heart (e.g., make the heart beat more times per minute) than what is required during rest. This results in a stronger heart that can pump more blood and deliver more oxygen to the body per heart beat, and a lower resting heart rate. Since most daily activities are aerobic in nature, improving the delivery of oxygen to the muscles will improve your work performance. (See "Fuel Used During Exercise" on page 26.) So, view your heart as an aerobic muscle that must be conditioned for optimum functional health and fitness throughout your life.



Benefits of Cardiorespiratory Exercise

The benefits of cardiorespiratory, or aerobic, conditioning include:

- A stronger heart and lower resting heart rate.
- Fitness and performance benefits, such as increased aerobic capacity and muscle endurance.
- Health benefits, such as maintenance of a healthy body weight and body fat percentage, management of stress, and decreased blood cholesterol and fat (triglycerides) levels.
- Increased performance in physically-demanding jobs such as lift-and-carries.
- Increased muscle tone and enhanced physical appearance.

Aerobic Exercise Guidelines

The FITT Principle guidelines discussed in Chapter 4 and outlined in the Physical Activity Pyramid for cardiorespiratory training are:

- **Frequency** - 3-7 days per week.
- **Intensity** - 60% to 90% of maximum heart rate (Max HR).
- **Time** - 30-60 minutes per day within your target heart rate zone.
- **Type** - continuous, low resistance, high repetition activities.

The guidelines for exercise “intensity” and “type” are discussed next.

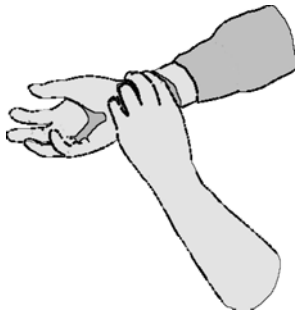
Intensity of Exercise

Intensity can be estimated using the following measures:

Target Heart Rate Zone

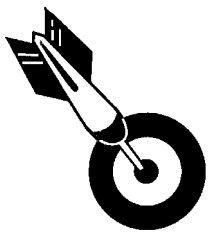
Measuring increases in heart rate during a workout is a quick and easy method to gauge the intensity of your workout. To measure your heart rate follow the instructions in Figure 5-1.

Figure 5-1. Measuring Heart Rate at the Wrist



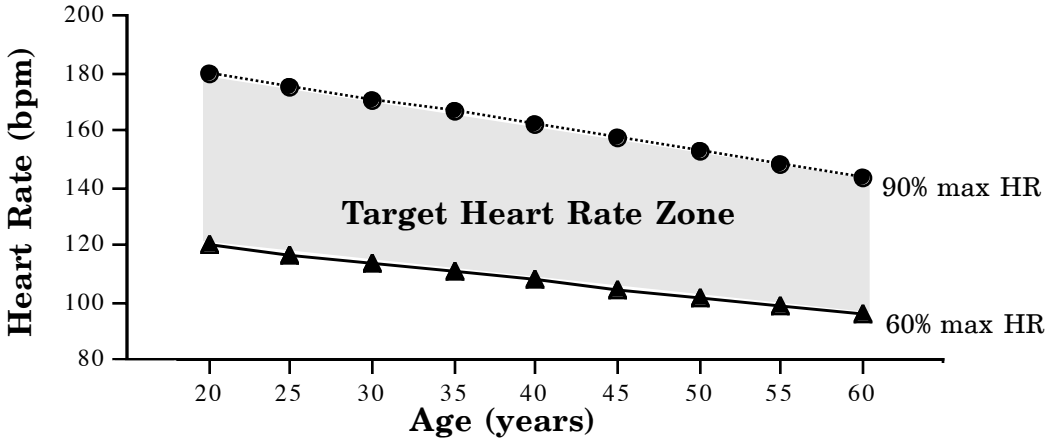
- Use your fingertips, not your thumb, to find your pulse at your wrist below your thumb.
- Count the beats for 10 seconds.
- Multiply this number by 6 to get your heart rate in beats per minute (bpm).

Once you measure your exercising heart rate how do you know whether you are exercising at the appropriate intensity? Depending on your age and fitness level there is a target heart rate zone that is appropriate for your exercise intensity. Use Figure 5-2 or Worksheet 5-1 to find your target heart rate zone.



See “Training Design and Progression” on page 33 to determine what heart rates, within this range, you should aim for during exercise based on your level of physical fitness and your fitness goals.

Figure 5-2. Target Heart Rate Zones



Note: Max HR is lower during swimming and arm exercises. For these activities, subtract 13 from Max HR before calculating your target training zone.

Worksheet 5-1. Determine Your Target Heart Rate

Age-Predicted Max HR = 220 - _____ your age = _____bpm.

60% max HR = _____max HR x 0.60 = _____bpm.

90% max HR = _____max HR x 0.90 = _____bpm.

Target HR Zone = _____ to _____ bpm.

Calories

Most exercise machines display "Calories" during an exercise session and the term is very familiar to most people. Calories per hour is the amount of energy you use when maintaining the same exercise intensity for an hour.

Perceived Exertion

Ratings of Perceived Exertion, or RPE, are the subjective measures of exercise intensity perceived by the exerciser. Measurements are based on a twenty-point scale, "6" is no exertion and "20" is maximal exertion. Most people should workout at a perceived exertion of 12 to 15 (moderate to hard).

Other Measures of Exercise Intensity

METs and **Watts** are two other measures of exercise intensity that are often calculated on exercise machines. A MET (metabolic equivalent) describes the amount of energy needed to perform an activity. Rest requires 1 MET, so exercising at 5 METs requires 5 times the energy needed at rest. A Watt is the amount of work (kcal) performed in a given time period. Therefore, the greater the watts (kcal/min), the higher the exercise intensity.

Type of Exercise

Continuous, low-resistance exercises (e.g., biking) train the heart and muscles to use oxygen more efficiently. To choose the best exercises for you to perform, consider the following:

- Training is exercise specific; e.g., run to improve your run time.
- Exercises that involve several muscle groups and are weight bearing will require the greatest amount of Calories to perform.
- Exercises that you enjoy the most are the best exercises for you.
- Alleviate boredom and decrease your risk for injuries by alternating the types of exercise you perform, i.e., **cross-train**.

Table 5-1. Examples of Aerobic Exercise

Activity	Advantages	Comments
Aerobic Classes	Group setting, variety of levels	Work at your own pace; ask instructor prior to class for any tips.
Bicycling	Low impact, good for cross-training	Bike at 70 rpms, with a slight bend in knee to best work the quadriceps muscles.
Climbing (Stairclimbing)	Weight bearing	Uses major muscles of lower body; weight-bearing (by not leaning arms on machine); Rock climbing strengthens upper body, too.
Cross-country Skiing	Low impact, good for cross-training	Uses most major muscle groups.
Jumping Rope	Can be performed in small quarters	A fast pace mimics running; wear good shoes and avoid cement surface.
Martial Arts	Group setting	Popular; many classes focus on flexibility, strength, and relaxation.
Rowing	Low impact	Works most major muscle groups.
Running	Minimal gear required	High impact, alternate with other exercises.
Swimming, water aerobics	No impact, can be a group setting	Uses most major muscle groups; great as a primary, cross-training, or rehab. exercise.
Walking	Low impact, minimal gear	Uses most major lower body muscle groups; weight-bearing.

There are several variations to these basic types of exercises, such as kickboxing, treading, and spinning.

Cross-Training

For overall health and general fitness benefits, and to avoid overuse injuries, alternate the types of exercises you perform, i.e., cross-train. Cross-

training allows you to build a good aerobic base while avoiding overuse injuries caused by the repetitive motions of a single exercise. Engaging in a variety of activities (e.g., alternating between running and swimming) uses different muscle groups.

For performance-related fitness, strategies to enhance your speed for activities that require fast, short-duration sprints (like soccer) are presented in Table 5-2.

Table 5-2. Various Training Strategies for Speed

Workout	Description
Intervals	Ratios of recovery to work; i.e., 3 minutes normal (recovery) pace, 1 minute sprint (work) pace (3:1); 30 second recovery to 15 second work (2:1), etc.
Fartleks (Speed Play)	Mix normal exercise pace with hard exercise pace in an unstructured pattern.
Time Trial	Exercise for predetermined distance at a race pace.
Pyramids	Exercise is divided in stages as follows: 1 minute (min) hard: 1 min rest, 3 min hard: 2 min rest, 5 min hard: 3 min rest, 7 min hard: 5 min rest, then work back down (5:3, 3:2, 1:1).
Sprint	Maximum exercise effort lasting 5-10 seconds, followed by complete recovery.
Acceleration Sprint	Jog 100 yards (yds.), then sprint 100 yds., then walk 100 yds.; repeat this pattern for a given distance or time.

Training Design and Progression

Now you are ready to design your aerobic workout! When designing a cardiovascular routine there are a few questions you must answer. These are:

Questions	
1. What are your goals?	Are your interests health, fitness, or performance related? Be specific.
2. What do you enjoy?	Do you prefer team or solitary activities? List 3 activities.
3. What are your time limits?	Be realistic about how much time you can devote.
4. What gear do you need?	Plan and budget to get the gear you need.

You want to tailor your program to realistically meet your goals and time demands, so answer the questions honestly (see Chapter 17 for more information on setting goals).

- If you have been sedentary, begin by increasing your physical activity by performing more daily activities, found in Level 1 of the Physical Activity Pyramid (Figure 4-2).
- Once you can easily perform these activities, add 5-10 minutes of Level 2 activities two to four days per week.
- Gradually increase the duration of the Level 2 activities by 10% per week until you can perform 20 to 60 minutes continuously. Your training intensity should be between 60% and 75% of your max HR (see Worksheet 5-1).
- Exercise at 80% to 90% of maxHR should only be performed by individuals in excellent physical fitness.

The golden rules of training progression are:

- Increase only one FITT component, i.e., frequency, intensity, time, or type, at a time.
- Increase your training by no more than 10% each week. Allow yourself time to adjust to this new routine before you increase your workout again. Increasing too fast will lead to injury and overtraining (see Chapter 13).
- Signs of overexertion include pain in your chest, breathlessness or gasping for breath, nausea, and dizziness. If you have any of these symptoms, stop exercising immediately!

Based on your answers to the questions above and your current fitness level, set up a weekly routine with moderate to hard workout days and rest days (Appendix B). You will add a strength training workout to this schedule in Chapter 7.